

a precursor comprising PFPE and PDMS blocks, and fluoroolefin-based precursor; and wherein the second layer of material can be the same as or different than the first layer of material; and

- 5 (iii) combinations thereof;
to form a multilayer device.

54. The method of Claim 53, wherein the first layer of material comprises a fully-cured material.

10 55. The method of Claim 53, wherein the contacting of the first layer of material with the substrate forms a reversible seal.

56. The method of Claim 53, wherein the first layer of material comprises a partially-cured material.

15 57. The method of Claim 56, wherein the partially-cured material comprises a partially-cured PFPE precursor material encapped with a methacrylate group.

58. The method of Claim 53, comprising treating the substrate with a silane coupling agent to form a treated substrate.

20 59. The method of Claim 58, wherein the silane coupling agent is selected from the group consisting of a monohalosilane, a dihalosilane, a trihalosilane, a monoalkoxysilane, a dialkoxysilane, and a trialkoxysilane; and wherein the monohalosilane, dihalosilane, trihalosilane, monoalkoxysilane, dialkoxysilane, and trialkoxysilane are functionalized with a moiety selected from the group consisting of an amine, a methacrylate, an acrylate, a styrenic, an epoxy, an isocyanate, a halogen, an alcohol, a benzophenone derivative, a
25 maleimide, a carboxylic acid, an ester, an acid chloride, and an olefin.

60. The method of Claim 56, comprising:

- 30 (a) contacting of the first layer of partially-cured material with the treated substrate; and
(b) treating the first layer of partially cured material to form a bond between the first layer of partially-cured material and the treated substrate.

61. The method of Claim 53, wherein:

- (a) the first layer of material comprises a first partially-cured

is encapped with a methacrylate group.

70. The method of Claim 68, comprising treating the PDMS precursor with a plasma treatment followed by treatment with a silane coupling agent.

5 71. The method of Claim 70, wherein the silane coupling agent is selected from the group consisting of a monohalosilane, a dihalosilane, a trihalosilane, a monoalkoxysilane, a dialkoxysilane, and a trialkoxysilane; and wherein the monohalosilane, dihalosilane, trihalosilane, monoalkoxysilane, dialkoxysilane, and trialkoxysilane are functionalized with a moiety selected
10 from the group consisting of an amine, a methacrylate, an acrylate, a styrenic, an epoxy, an isocyanate, a halogen, an alcohol, a benzophenone derivative, a maleimide, a carboxylic acid, an ester, an acid chloride, and an olefin.

72. The method of Claim 62, comprising:

- 15 (a) contacting the partially-cured multilayer structure with a substrate, wherein the substrate is coated with a partially-cured precursor material to form a second partially-cured multilayer device; and
(b) treating the second partially-cured multilayer device to form a second fully-cured multilayer device.

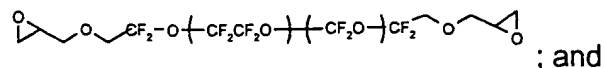
20 73. The method of Claim 72, wherein the treating comprises a process selected from the group consisting of a thermal curing process, a chemical curing process, a photoacid curing process, and a catalytic curing process.

25 74. The method of Claim 53, wherein at least one of the first layer of material and the second layer of material comprises a material formed from a two-component PFPE precursor material, wherein the two-component PFPE precursor material comprises a mixture of two functionalized PFPE components blended in a stoichiometric ratio.

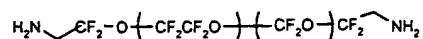
30 75. The method of Claim 74, wherein the two-component PFPE precursor system comprises a mixture of components selected from the group consisting of an epoxy/amine mixture, a hydroxyl/isocyanate mixture, a hydroxyl/acid chloride mixture, and a hydroxyl/chlorosilane mixture.

76. The method of Claim 75, wherein epoxy/amine mixture

comprises a PFPE diepoxy compound comprising the following structure:



a PFPE diamine compound comprising the following structure:



5 77. The method of Claim 75, wherein the epoxy/amine mixture comprises a stoichiometric ratio ranging from about 4:1 epoxy:amine to about 1:4 epoxy:amine.

78. The method of Claim 77, wherein the stoichiometric ratio is about 4:1 epoxy:amine.

10 79. The method of Claim 78, comprising:

- (a) providing a substrate, wherein the substrate is treated with a silane coupling agent;
- (b) contacting the first layer of material formed from a two-component PFPE precursor material comprising a stoichiometric ratio of about 4:1 epoxy:amine with the substrate; and
- (b) treating first layer of material and the substrate to form a multilayer device.

15 80. The method of Claim 79, wherein the silane coupling agent comprises aminopropyltriethoxy silane.

81. The method of Claim 77, wherein the stoichiometric ratio is about 1:4 epoxy:amine.

82. The method of Claim 81, comprising:

- (i) providing a first layer of material comprising a stoichiometric ratio of about 1:4 epoxy:amine;
- (ii) contacting the first layer of material comprising a stoichiometric ratio of about 1:4 epoxy:amine with a second layer of material comprising a stoichiometric ratio of about 4:1 epoxy:amine; and
- (iii) treating the two layers of material to form a multilayer device.

83. The method of Claim 78, comprising:

- (i) providing a first layer of PDMS material;
- (ii) treating the first layer of PDMS material with plasma treatment followed by treatment with a silane coupling agent to form a treated layer of PDMS material;
- (iii) contacting the treated layer of PDMS material with a second layer of material comprising a stoichiometric ratio of about 4:1 epoxy:amine; and
- (iv) treating the two layers of material to form a multilayer device.

84. The method of Claim 83, wherein the silane coupling agent comprises aminopropyltriethoxy silane.

85. The method of Claim 74, comprising:

- (a) providing a first layer of material formed from a two-component PFPE precursor material, wherein the two-component PFPE precursor material comprises a mixture of two functionalized PFPE components blended in a stoichiometric ratio;
- (b) treating the first layer of material to form a first layer of partially-cured material;
- (c) contacting the first layer of partially-cured material with one of:
 - (i) a substrate;
 - (ii) a second layer of material; and
 - (iii) combinations thereof; and
- (d) treating the first layer of partially-cured material to adhere the partially-cured material to one of the substrate, a second layer of material, and combinations thereof.

86. The method of Claim 85, wherein the substrate is selected from the group consisting of a glass material, a quartz material, a silicon material, and a fused silica material.

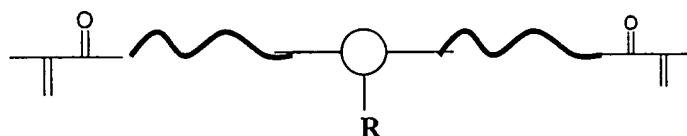
87. The method of Claim 86, comprising treating the substrate with a silane coupling agent.

88. The method of Claim 87, wherein the silane coupling agent is selected from the group consisting of a monohalosilane, a dihalosilane, a trihalosilane, a monoalkoxysilane, a dialkoxysilane, and a trialkoxysilane; and wherein the monohalosilane, dihalosilane, trihalosilane, monoalkoxysilane, dialkoxysilane, and trialkoxysilane are functionalized with a moiety selected from the group consisting of an amine, a methacrylate, an acrylate, a styrenic, an epoxy, an isocyanate, a halogen, an alcohol, a benzophenone derivative, a maleimide, a carboxylic acid, an ester, an acid chloride, and an olefin.

89. The method of Claim 85, wherein the second layer of material comprises a PFPE precursor material.

90. The method of Claim 85, wherein the second layer of material comprises a poly(dimethylsiloxane) material, wherein the poly(dimethylsiloxane) material is treated with an oxygen plasma followed by treatment with a silane coupling agent.

91. The method of Claim 53, wherein the PFPE precursor material comprises the following structure:



wherein:

R comprises an epoxy group;

the circle comprises a linking molecule; and

the wavy line comprises a PFPE chain.

92. The method of Claim 91, comprising photocuring the PFPE precursor material to form a layer of fully-cured PFPE material.

93. The method of Claim 92, comprising:

(a) contacting the layer of fully-cured PFPE material with one

of:

(i) a substrate;

(ii) a second layer of material; and

(iii) combinations thereof; and

(b) treating the fully-cured material to bond it to one of the substrate, the second layer of material, and combinations

thereof.

94. The method of Claim 93, wherein the substrate is selected from the group consisting of a glass material, a quartz material, a silicon material, and a fused silica material.

5 95. The method of Claim 94, comprising treating the substrate with a silane coupling agent.

96. The method of Claim 95, wherein the silane coupling agent comprises aminopropyltriethoxy silane.

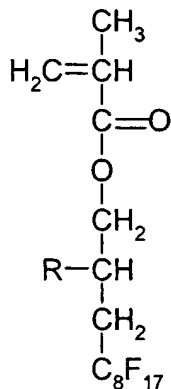
10 97. The method of Claim 93, wherein the second layer of material comprises a PFPE material.

98. The method of Claim 93, wherein the second layer of material comprises a treated PDMS material, and wherein the treated PDMS material is treated with an oxygen plasma followed by treatment with a silane coupling agent.

15 99. The method of Claim 98, wherein the silane coupling agent is selected from the group consisting of a monohalosilane, a dihalosilane, a trihalosilane, a monoalkoxysilane, a dialkoxysilane, and a trialkoxysilane; and wherein the monohalosilane, dihalosilane, trihalosilane, monoalkoxysilane, dialkoxysilane, and trialkoxysilane are functionalized with a moiety selected
20 from the group consisting of an amine, a methacrylate, an acrylate, a styrenic, an epoxy, an isocyanate, a halogen, an alcohol, a benzophenone derivative, a maleimide, a carboxylic acid, an ester, an acid chloride, and an olefin.

100. The method of Claim 53, comprising blending the PFPE precursor with a functional monomer to form a PFPE precursor blend.

25 101. The method of Claim 100, wherein the functional monomer comprises the following structure:



102. The method of Claim 100, comprising photocuring the PFPE precursor blend to form a layer of fully-cured PFPE material.

103. The method of Claim 102, comprising:

- 5 (a) contacting the layer of fully-cured PFPE material with one of:
 - (i) a substrate;
 - (ii) a second layer of material; and
 - (iii) combinations thereof; and
- 10 (b) treating the layer of fully-cured material to bond it to one of the substrate, the second layer of material, and combinations thereof.

104. The method of Claim 103, wherein the substrate is selected from the group consisting of a glass material, a quartz material, a silicon material, and a fused silica material.

105. The method of Claim 104, comprising treating the substrate with a silane coupling agent.

106. The method of Claim 105, wherein the silane coupling agent is selected from the group consisting of a monohalosilane, a dihalosilane, a trihalosilane, a monoalkoxysilane, a dialkoxysilane, and a trialkoxysilane; and wherein the monohalosilane, dihalosilane, trihalosilane, monoalkoxysilane, dialkoxysilane, and trialkoxysilane are functionalized with a moiety selected from the group consisting of an amine, a methacrylate, an acrylate, a styrenic, an epoxy, an isocyanate, a halogen, an alcohol, a benzophenone derivative, a maleimide, a carboxylic acid, an ester, an acid chloride, and an olefin.

107. The method of Claim 103, wherein the second layer of material